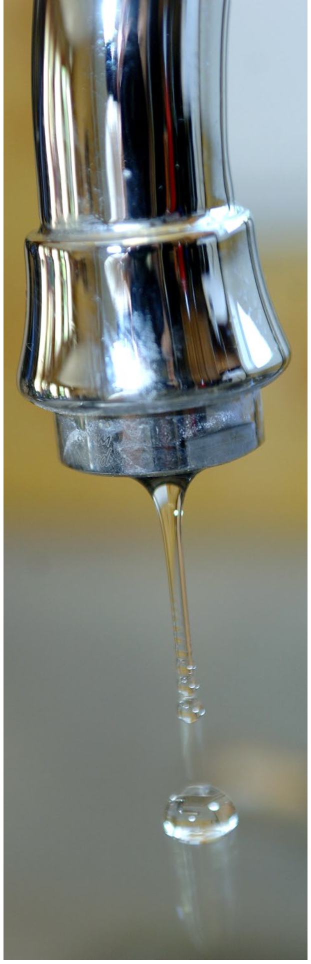
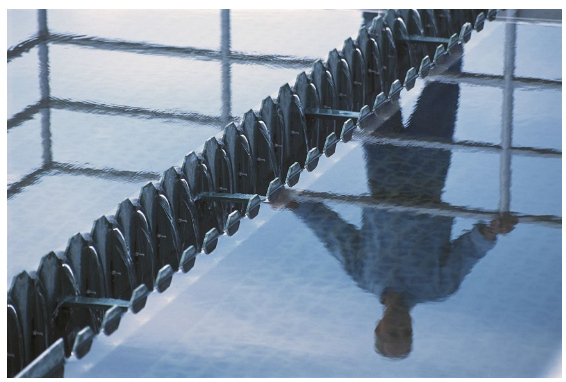


United States
Environmental Protection
Agency

Water Availability, Water Variability and Water Efficiency Considerations in Public Water System Supervision Programs

Supporting resiliency to climate related impacts in public water systems



Office of Water (4606M)
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Table of Contents

I. Introduction

The availability and variability of public water supplies are affected by many factors including population growth, water scarcity, climate related impacts such as droughts and extreme weather events as well as contaminants of emerging concern and aging infrastructure. Both water availability and variability issues can lead to higher costs, loss of revenue, difficulties meeting customer needs, and challenges to the treatment and distribution of safe drinking water for public water systems. Water scarcity can lead to the long-term challenge of finding a new source of adequate quality or increasing costs to treat sources with impaired quality. Water shortages can serve as a signal to public water systems to implement best management practices (BMPs) through supply-side management (e.g., source water protection, storage) and/or demand management (e.g., increased efficiency and conservation by system and customers).

Regular, proactive monitoring and surveillance of both the capacity and quality of water sources allows public water systems to plan for additional sources of supply to meet demand. They allow systems to take proactive measures to protect the quality of existing sources of supply and prepare to meet water treatment and distribution challenges posed by changes in the quantity or quality of sources of supply.

By implementing water efficiency and conservation BMPs, a system may eliminate the need to invest in identifying a new source, adding treatment, or increasing storage capacity and can increase resiliency to climate related impacts. Increased efficiency and conservation can be achieved through rate setting, public education, customer conservation programs, water metering and audits, repair and replacement of aging infrastructure, and implementing a water loss control program. Water audits and water loss control programs can reduce distribution system leakage, leading to lower production costs. Customer water conservation programs can reduce the amount of water produced and used and, when combined with appropriate rate structures, can prolong the life of the water source and reduce treatment costs.

This document includes questions and considerations that address water availability, water variability (both quantity and quality), and water efficiency, criteria that can be incorporated into Safe Drinking Water Act (SDWA) Public Water System Supervision (PWSS) Programs at the state, tribal and local level. The goals of these considerations are to (1) assess the sustainability of the water supply and the variability of the source (2) support resiliency to climate related impacts in public water systems and (3) improve system awareness and involvement with respect to water and energy efficiency and conservation. These considerations can be incorporated as described into SDWA primacy agency sanitary survey and field inspection programs, plan review and other oversight, outreach and technical assistance programs and efforts.

II. Water Availability

Public water systems need a sufficient supply of water to reliably deliver safe drinking water. Water supplies and the demands on those supplies are impacted by factors including:

- Population and economic trends
- Legal decisions
- Climate related impacts such as extended droughts and extreme weather events
- Contaminants of emerging concern
- Infrastructure needs or changes

The assessment of a public water system’s ability to meet current demands and any future increases in demand would be a part of sanitary surveys, plan review or other state oversight programs.

In many parts of the country, constraints on the use of both surface water and ground water exist. Changes in demand due to population increase or changes in source capacity due to short-term or long-term droughts may increase those constraints. For many public water systems, the options for dealing with a decreased supply or increased demand on a permanent basis may be limited. Many existing resources are stressed, and those stresses may be increasing with competition for those resources resulting in limited availability. Alternative sources may be farther way, limited in capacity, or of lower quality. They may require increased expenses and energy consumption to pump, treat and distribute water supplies.

Some states (e.g. California, Minnesota) require public water systems to address water availability in water supply plans. Minnesota (Minnesota Statutes 103G.291) requires a plan for public water systems serving more than 1,000 persons that includes a 10-year demand forecast as well as demand reduction procedures and enforceable water conservation restrictions for use in water supply shortages. California (Water Code Division 6, Part 2.6) requires an Urban Water Management Plan for public water systems serving more than 3,000 people that includes a 20-year demand forecast as well as elements to address water supply shortages.

Considerations in reviewing long-term water availability and supply capacity include:

- Has the water system conducted a systematic evaluation of its sources in terms of quantity?
- Are shortages anticipated in the next 5 to 20 years? If so, what is the system's plan to address shortages?
- Has the water system conducted a systematic water demand forecast? Is water demand anticipated to change substantially over the next 5 to 20 years? If so, what is the water system's plan to meet this demand?
- How long ago was the forecast conducted? Were all possible demand factors considered? What type of forecast method was used?
- Are there water rights or contractual limitations on raw water supplies? Is there potential for limitations to be changed?
- If the water system purchases finished water to meet demand, is the available quantity of the purchased supply expected to change?
- Are contracted or allocated supplies of purchased finished water adequate to meet any expected increases in water supply demands?

Examples of state programs addressing water supply and drought management in public water systems in Alabama, Arizona, and states in USEPA Region 4 are described in Appendix 1. Also included in Appendix 1 is a description of the Mississippi State Department of Health's (MSDH) Capacity Development program that includes consideration of whether the system has alternative or backup water supply sources and emergency tie-ins as part of the capacity evaluation.

A sanitary survey, plan review or capacity assessment would also include a review and appraisal of current water supply availability and source capacity. Some states have regulatory requirements based on current population served or measured demand. The Recommended Standards for Water Works (2018) commonly referred to as "Ten State Standards," states that surface water sources should have the capacity to meet maximum demands, calculated based on a one in 50-year drought (or the most extreme drought on record). These calculations should also take into consideration multi-year droughts. These standards also state that the capacity of ground water sources should be able to meet or exceed the maximum daily demand while the well that normally produces the largest volume of water is not in service. The standards also recommend that a minimum of two ground water sources be provided to help ensure the availability of water (Water Supply Committee of the Great Lakes 2018) Considerations in addressing near term source availability and reliability include:

- Has the water system experienced water shortages in the past five years? If so, how frequently and how did the water system respond?
- Does the system monitor (or have access to) surface supply flows or ground water static water levels? Are they tracked over time? Are they decreasing?
- Are there multiple intakes available and are they maintained?
- Does supply availability or capacity vary by season?
- Is supply affected by drought? How frequent and what is the duration of the past drought events?
- How does the water system currently manage changes in water availability or quantity?
- Are alternative or additional supplies available to meet short-term needs or emergencies? Can they be used with existing treatment and pumping/transmission facilities?

For public water systems that purchase water or do not have access to streamflow, lake levels or other surface water data, the information may be available to state and technical assistance providers from the wholesale supplier, state water resource agencies, and local and federal agencies.

As described previously, states that require water supply plans may require those plans to include planning for supply emergencies and droughts. A drought management plan and addressing supply emergencies in emergency plans will help public water systems that experience problems with water availability during dry years or are vulnerable to supply emergencies prepare for and respond to these events. Several states have prepared guidance for public water systems on developing drought management plans. For example, the Tennessee Department of Environment and Conservation (2009) has prepared a series of materials on drought management including a comprehensive guidance on how community water systems can prepare their own drought management plans. https://www.tn.gov/content/dam/tn/environment/water/documents/droughtmgtplan_guidance.pdf

The Utah Department of Natural Resources (2008) developed a Drought Management Toolkit for Public Water Supplies. The EPA has developed a Drought Response and Recovery Guide (2018) that includes worksheets, best practices, key resources and a Drought Response Plan template for any sized water system to use if the state does not have specific requirements.

III. Water Variability

Droughts and extreme weather events may result in variability in the quantity of the supply available to a public water system to meet supply demands. Additionally, drought and extreme weather events, as well as the presence of contaminants of emerging concern, may result in variability in the quality of the supply used by a public water system. Variability in water supply or quality may impact the ability of a public water system to provide a reliable supply of drinking water that meets federal and state standards.

Source Water Quantity Variability

Variability in the supply available to a public water system can be addressed with additional supplies, adequate storage and operational efficiencies. A review and assessment of the capacity of available supplies and system storage would be part of sanitary surveys, plan reviews and other state processes (e.g., permits). Considerations for variability in source water supply include:

- Does the supply vary by season? During which period is water most abundant?

- Does the water system have plans or procedures to respond to variations in their source water supplies?
- Does the water system have an asset management program that includes source water considerations?
- Does the water system track or have access to flow records and reservoir levels for its sources?
- If a lake or reservoir is a source, are multiple intake depths/locations available for variations in water levels?
- What is the capacity of raw water/off stream storage? Is it adequate to meet existing or expected seasonal variations?
- Are alternate/emergency supplies monitored regularly and are intakes, pumps and valves maintained in operational condition
- Are there constraints or limits such as permit requirements, water rights or hydraulic limitations on reserve or alternate sources?
- Does the capacity/flow of ground water source vary? If so, how does the system meet demand during those periods?
- Are consecutive water systems subject to reductions in supply due to wholesale supply variations? If so, does the consecutive system have alternatives or contingencies to meet demands?

Finished water storage in the distribution system allows a public water system to continue to meet system demand during short-term variations in water supply. These variations may result from normal system operational variations in pumping or treatment, weather events that result in changes in treatment or changes in the source used or other circumstances (e.g., fires, heat waves) that impact system demand.

Some states have minimum requirements for finished water storage. The Ten State Standards call for a minimum capacity in finished water storage tanks and reservoirs to provide for the system's average daily consumption (Water Supply Committee of the Great Lakes, 2018). An evaluation of finished water storage would be part of a sanitary survey or plan review process. Considerations for finished water storage include:

- Are storage tank and reservoir capacities adequate to address variations in source capacity?
- Have storage tank and reservoir capacities been evaluated considering increases in system demand?
- Are storage tanks and reservoirs adequately maintained to ensure long-term reliability?

Source Water Quality Variability

Extreme weather events such as droughts and flooding, as well as the potential for contamination by contaminants of emerging concern, may result in variability in the quality of the supply used by a public water system. Extended drought conditions can result in raw water quality changes due to changes in watershed and limnologic conditions or salt water intrusion in coastal areas. Significant wet weather events and flooding can negatively alter influent water quality. Intense rainfall and stormwater runoff may result in changes in water quality (turbidity, pH, alkalinity), watershed conditions, or in increases in contaminant loadings in runoff from nutrients, pesticides, and fecal matter. These variations may require changes to water treatment practices to continue to meet drinking water standards.

Some important source water quality variables and the impacts of variability follow in Table 1.

Table 1. Source Water Quality Variables and the Impacts of Variability

Water Quality Variable	Impacts of Variability
Temperature	Increasing water temperature can increase the rate of disinfection by-product formation, result in taste and odors and affect corrosion control (pH falls as temperature increases). Warmer water in the distribution system encourages microbial regrowth and the potential for the presence of opportunistic pathogens such as *Naegleria* and *Legionella*.
Total Organic Carbon (TOC)	Increasing TOC and natural organic material (NOM) from watershed and source water quality changes will affect the species and increase the rate of formation of disinfection by-products. Carbon dioxide increases in water supplies may cause pH to decrease. Increasing TOC may require treatment changes to meet removal requirements.
Algae	Increased algae concentration (i.e., blooms) from higher water temperatures, drought and extreme weather and increased nutrient levels can result in taste and odors and may require treatment changes. Algal toxins with potential health effects can be released in both source water and treated water.
Alkalinity	Decreasing alkalinity from source water quality changes due to drought or increased runoff may require changes to treatment practices such as coagulation. Low alkalinity results in unstable pH that negatively affects corrosion control.
pH	Changes in pH can affect coagulation processes (lower, stable pH desirable) and corrosion control (higher, stable pH desirable). Increased pH will reduce chlorine disinfection efficacy.
Turbidity	Increased turbidity from runoff in storm events or watershed changes will require increased coagulation, reduce filtration efficiency, and will interfere with disinfection.
Salinity	Increased salinity from saltwater or brackish water intrusion can affect coagulation, cause tastes and odors and may require advanced treatment (e.g. nanofiltration or reverse osmosis).
Pesticides and fertilizers	The presence of pesticides and nitrogen from fertilizer in increased runoff may require the use of advanced treatment processes. Nitrogen and phosphorus can result in changes in source water quality.
Inorganics (e.g., bromide, metals, nitrogen compounds)	Bromide from saltwater intrusion will result in bromate, a regulated disinfection byproduct, formation in treatment. Increased iron and manganese from source water quality changes (e.g., hydrologic or limnology) can result in color and taste and odors and may require additional treatment. Increased nitrogen from runoff and source water changes contributes to the formation of nitrite and nitrate.
Pathogens and other microbial contaminants	Increases in microbial contamination of source water from increased runoff, point discharges and overflows may require increased disinfection or additional disinfection treatment (e.g., ultraviolet (UV) disinfection for *Cryptosporidium*).

In some cases, existing water treatment processes may be adequate to continue to provide drinking water that meets current standards with changes or variations in source water quality. In other cases, such as significant changes in water quality (e.g., saltwater intrusion) or the occurrence of contaminants of emerging concern, treatment modification or additional treatment may be necessary. A review and assessment of the existing treatment processes and the capacity to continue to meet drinking water standards with expected source water quality changes would be part of sanitary surveys, plan reviews and other state processes (e.g., permits). Considerations for source water quality variability include:

- Does the water system monitor and track source water quality and watershed conditions?
- Does the water system experience weather-related or seasonal changes in source water quality or watershed conditions?
- Do intakes or pumping equipment allow for modifications to address change in source water quality?
- Does the quality of ground water supplies vary seasonally, with weather events, or with pumping rates?
- Can water quality changes be addressed with changes in operations or modifications to existing treatment or would additional treatment be required?
- Are contaminants of emerging concern a concern for the source water?

IV. Water Efficiency

The efficient use of water can help reduce demand on water supplies as well as demands on water system infrastructure and help public water systems deal with both short-term and long-term changes in water availability and water quality. Improvements in water efficiency can provide important public water system sustainability benefits, including reducing or delaying the need for capital projects and reducing energy use. Water efficiency may also provide some financial benefits from less non-revenue water such as reduced treatment chemicals costs. Water efficiency improvements can also provide environmental sustainability benefits such as reduced pressure on water resources.

Improvements in water efficiency can be achieved both in the water distribution system (supply-side) and at the customer level (demand-side). At the system level or supply-side, improvements in water efficiency begin with metering, water audits and water loss control programs. Some states have standards for distribution system water losses or requirements for water audits. Leak detection and repair can minimize the potential for intrusion into distribution systems and has important public health benefits. An evaluation of water losses and control could be part of sanitary surveys, capacity assessments, plan reviews, or other state oversight programs.

In states without regulatory requirements, water efficiency improvements could be part of state or technical assistance provider outreach, education, and assistance efforts.

Considerations in supply-side water efficiency include:

- Is the water distribution system metered?
- Does the water system have a meter calibration and repair program?
- Does the water system have a meter replacement program?
- Is data collected for evaluating distribution system leakage?
- Does the water system meet state standards for water loss/leakage?
- Is a leak detection program in place?
- Have any water loss studies been completed? If so, what is the water system doing in response to the findings?

EPA published Water Efficiency For Public Water Systems (EPA 816-F-13-003) for small and medium-sized public water systems as well as technical assistance providers and state programs that support or regulate these public water systems. That document introduces water efficiency for public water systems, identifies measures to improve water efficiency and provides recommendations on how public water systems can get started and continue making water efficiency improvements.

Steps in Improving Water Efficiency

Water Metering

Metering is essential for a public water system to gain an understanding how much water the system uses and loses. Metering allows a system to measure the volume of water flowing into, through and out of the system as well as the volume of water used by customers.

Further information on types of meters, metering points and metering programs can be found in Control and Mitigation of Drinking Water Losses in Distribution Systems (EPA 816-R-10-019).

Technological advances have yielded much more powerful tools for public water systems to monitor water use and loss than the traditional manual-read meters. Automated meter reading (AMR) allows public water systems to measure water use per connection remotely and in real time, which not only allows for more accurate and frequent billing (itself a measure to improve water efficiency) but also is an important tool for detecting changes that might indicate significant water loss.

Water Audits

Public water systems can use metering and other monitoring data to establish a baseline understanding of how much water the system uses and loses. This is typically accomplished with a water audit. Public water systems have numerous options for how to conduct a water audit. There are many resources available from state and federal agencies to help public water systems plan for an audit and resources to support water audits. For more information on conducting a water audit, please see EPA's Water Audit and Water Loss Control for Public Water Systems (EPA 816-F-13-002) guidance document.

Through water audits and on-going water accounting, public water systems can learn how much water is being lost or wasted at each stage from source-to-tap and pinpoint problem areas so that operation improvements and maintenance can be properly prioritized and targeted to maximize water efficiency. Further, as the public water system implements water efficiency projects and operational changes, public water systems can use their baseline water audit to evaluate the effectiveness of the changes and to measure the increases in water efficiency.

The American Water Works Association has free software available for public water systems that want to conduct a standard water audit of their system. The AWWA tool is available from the AWWA website.

In addition, AWWA has published a guidance manual on conducting water audits and implementing proactive water loss control programs, Manual M36, Water Audits and Loss Control Programs, Fourth Edition (2016). The Texas Water Development Board has developed a water audit manual, Water Loss Audit Manual for Texas Utilities (Report 367), with worksheets and audit forms.

Descriptions of state agency water audit programs for public water systems in Georgia and Oklahoma, as well as the South Carolina public water system oversight effort that incorporates water audits as an element of the South Carolina's sanitary survey program, are included in the Appendix.

Water Loss Control

A well-implemented water loss control program can reduce water and revenue loss and protect public health by reducing the threat of sanitary defects that may allow microbial or other contaminants to enter the finished water. A water loss control program should be flexible and tailored to the specific needs and characteristics of a public water system. There are three major components to an effective program:

1. The Water Audit
2. Intervention
3. Evaluation

EPA has published a resource document on water loss control, Control and Mitigation of Drinking Water Losses in Distribution Systems (EPA 816-R-10-019) which provides detailed information on how systems can account for their water and create a leak detection and repair strategy. EPA also published Water Audits and Water Loss Control for Public Water Systems (EPA 816-F-13-002), which introduces water loss control and information on the use of water audits in identifying and controlling water losses with a focus on smaller public water systems.

Public water systems that do not have the resources for comprehensive water loss control programs still have opportunities to reduce lost water by addressing leaking pipes and storage, replacing inaccurate and malfunctioning meters and eliminating unauthorized use. Many public water systems are aware of at least some of the leaks in their distribution system and that can be an easy way to get started.

The Virginia Department of Health's Office of Drinking Water takes advantage of the Drinking Water State Revolving Fund Capacity Development Set-Aside funds to support leak detection programs for public water systems through the Virginia Rural Water Association. A description of this program is included in the Appendix.

Pressure Management

Managing water pressure is another way that public water systems can improve water efficiency and manage water losses. Pressure differences may occur across a system for many reasons; the simplest reason is variance in elevation differential between water sources and end users. Eliminating excess pressure can:

- Reduce the volume of leaks and decrease flow through open taps or faucets
- Limit future losses by reducing stresses on pipes and joints; limiting the risk of new leaks
- Save money by increasing the life of both system and end-user components by decreasing wear

To identify potential areas within a system for pressure reduction, desktop models and field studies may be needed. Because maintaining adequate pressure is often critical to maintaining the quality of drinking water and to the integrity of the drinking water system, all pressure reductions should be conducted in full accordance with applicable regulations.

Demand Management

While water efficiency efforts on the system or supply-side can be effective, water efficiency efforts on the customer or demand side can have significant long-term effects and may be needed to address short-term or long-term supply availability and variability or increasing demand.

As described previously, states that require water supply plans may require those plans to include planning for demand reduction during supply shortages. Minnesota (Minnesota Statutes 103G.291) requires a plan for public water systems serving more than 1,000 persons that includes demand reduction procedures and enforceable water conservation restrictions for use in water supply shortages. Where demand management is not a part of state regulatory oversight programs, sanitary surveys, and other field contacts as well as technical assistance programs provide opportunities to inform public water systems of available resources and tools to improve water efficiency on the customer side.

Demand side management measures fall along a spectrum (presented in order from passive measures to measures based in supplier service authorities):

- Education
- Water-use audits
- Rebate and incentive programs
- Water reuse and recycling
- Water pricing
- Water-use regulations

In some states, resources and tools related to demand management may not be part of state drinking water oversight programs and contacts and cooperative programs may need to be established.

Information and resources related to reducing customer water use is available from EPA's WaterSense program. The WaterSense program has developed water efficiency standards for many common appliances and fixtures including water efficient toilets, shower heads and faucets. EPA developed the Water Conservation Plan Guidelines (EPA-832-D-98-001) that provides information for both state primacy agencies and public water systems to use in developing and implementing water conservation plans as part water supply demand management. In addition, EPA developed the Drought Response and Recovery Guide which provides examples of demand management from multiple utilities who have experienced water shortages.

States can use Drinking Water State Revolving Fund (DWSRF) set-aside resources to educate operators, system staff and community boards about the importance of water efficiency. These set-asides can pay for water audits, leak detection efforts, designing new rates and funding rebate/incentive programs. Another powerful way states can use their DWSRF program is to create incentives for public water systems to implement water efficiency measures. Some states give public water systems applying for a DWSRF loan bonus points for water efficiency efforts, while other states make a water efficiency plan a condition of receiving assistance.

Connections to Other Office of Water (OW) Programs and Activities

Incorporating the issues of Water Availability, Water Variability and Water Efficiency into the PWSS program can complement other OW programs for public water system sustainability and reliability. These programs would include:

- Water Security – Ensuring that an adequate supply is always available to meet demands and that is capable of meeting any new challenges in treating that supply are important components in maintaining public water system resiliency.
- Regulatory Compliance – Efforts to monitor and respond to changes in source water quality provide a proactive and preventative approach to ensure continuing compliance with National Primary Drinking Water Regulations.
- Asset Management – Implementing water efficiency and conservation BMPs may eliminate the need to invest in identifying a new source, adding treatment, or increasing storage capacity. Increased efficiency and conservation can be achieved through rate setting, public education, customer conservation programs, water metering and audits, repair, and replacement of aging infrastructure, and implementing a water loss control program.
- Source Water Protection – Source Water Protection programs serve to maintain or enhance the quality of source water used by PWSs. Source Protection efforts can reduce the potential need for treatment changes or adding treatment or the need to find alternative water sources to address degradation of source water quality.

References

American Water Works Association 2016. Manual M36: Water Audits and Loss Control Programs, Fourth Edition. Denver, CO.

American Water Works Association. Free Water Audit Software. https://www.awwa.org/resources-tools/water-knowledge/water-loss-control.aspx

Tennessee Department of Environment and Conservation. 2009. Guidance for Developing Community Water System Drought Management Plans. http://www.tn.gov/assets/entities/environment/attachments/droughtmgtplan_guidance.pdf

Texas Water Development Board. 2008. Water Loss Audit Manual for Texas Utilities (Report 367). March 2008. http://www.twdb.texas.gov/publications/brochures/conservation/doc/WaterLossManual_2008.pdf?d=1501015249853

U.S. EPA 2013. Water Efficiency for Public Water Systems (EPA 816-F-13-003). https://www.epa.gov/dwcapacity/water-efficiency-and-conservation-resources-small-drinking-water-systems

U.S. EPA 2013. Water Audits and Water Loss Control for Public Water Systems (EPA 816-F-13-002). https://www.epa.gov/dwcapacity/water-efficiency-and-conservation-resources-small-drinking-water-systems

U.S. EPA. 2010. Control and Mitigation of Drinking Water Losses in Distribution Systems (EPA 816-R-10-019). https://www.epa.gov/dwcapacity/water-efficiency-and-conservation-resources-small-drinking-water-systems

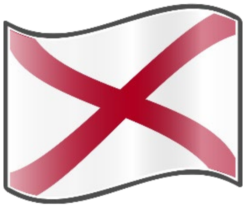
U.S. EPA. 1998. Water Conservation Plan Guidelines (EPA-832-D-98-001). https://www.epa.gov/watersense/water-conservation-plan-guidelines

U.S. EPA 2018. Drought Response and Recovery Guide (EPA-810-B-17-003). https://www.epa.gov/waterutilityresponse/drought-response-and-recovery-water-utlities
Utah Department of Natural Resources. 2008. Drought Management Toolkit for Public Water Suppliers. https://water.utah.gov/OtherReports/ManagementTOOLKIT/DroughtManagementToolkit.pdf

Water Supply Committee of the Great Lakes--Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. 2018. Recommended Standards for Water Works. Minnesota's Bookstore-Communicaions Media Division, St. Paul, MN 55155. 2018 Edition.

Appendix

State Program Examples



Alabama – Statewide Water Supply and Drought Management Plans

On June 24, 2011, Governor Robert Bentley released Executive Order 19 (amended in 2013), which formally requires a statewide drought plan. The Alabama Office of Water Resources (AOWR) finalized the Alabama Drought Management Plan (ADMP) to implement the guidance in the Executive Order and establish an Alabama Drought Declaration process. This process establishes a structure for drought monitoring, preparation, mitigation, and response.

In 2014, the Alabama Drought Planning and Response Act was signed into law. The law codifies most of the language in the Executive Order, clarifies the role of state agencies and requires all public water systems to create and submit water conservation plans. The law maintains the focus of "coordination and communication" of the ADMP and formalizes the organizational structure of the Alabama Drought Assessment and Planning Team and the Monitoring and Impact Group. The law is intended to improve reporting by public water systems on local conditions and source water.

This information was provided by Tom Little, Chief, Water Management Branch, Alabama Office of Water Resources Division.

Arizona – Statewide Water Supply and Drought Management Plans

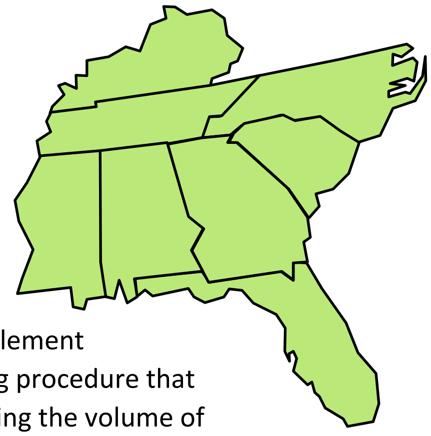
In 2003, the Arizona governor established a statewide Drought Task Force in response to prolonged drought that began in the mid- to late-1990s. The task force developed the Arizona Drought Preparedness Plan (ADPP), which was finalized in 2004 and implemented in 2006. The Arizona Departments of Water Resources (ADWR) administers the community water system reporting requirements, facilitates the State Drought Interagency Coordinating Group and State Drought Monitoring Technical Committee, and provides drought program staff support and web services according to the guidelines set in the ADPP.

The ADPP recommended a set of regulations for drought planning and water use. In 2005, these recommendations were adopted by the Arizona Legislature in House Bill 2277. Under these new regulations, community water systems are required to develop a System Water Plan and submit annual water use reports to the state.

System water plans include a water supply plan, water conservation plan, and a drought preparedness and response plan and must be updated every five years. The plans are required to describe how water providers will prepare and respond to varying stages of drought. Annual water use reports provide information on water received and delivered, and effluent used or received. The Arizona Department of Water Resources hosts a water resources annual water withdrawal and use online reporting tool where community water systems can submit water use data each year.

This information was provided by Ruth Greenhouse at the Arizona Department of Water Resources.

EPA Region 4 – Area wide Optimization program



Since 1997, the Region 4 Safe Drinking Water Branch has partnered with state drinking water programs and EPA's Technical Support Center to enhance the operations of drinking water utilities through the Area-Wide Optimization Program. Operational improvements aimed at improving drinking water quality have also resulted in significant water savings at public water systems.

The optimization program in Region 4 has helped water systems implement Extended Terminal Subfluidization Wash (ETSW), a filter backwashing procedure that reduces the time required for "ripening" a filter and therefore reducing the volume of water used and the amount of energy required during the ripening process. Several water systems in Region 4 implemented ETSW and reported large water savings:

- **The Town of Berry, Alabama** operates a water treatment plant with a treatment capacity of 1.0 million gallons per day (MGD). ETSW studies at the plant have resulted in changes to backwash procedures that are saving approximately 3.1 million gallons of water per year.
- **The Smiths Station Water Treatment Plant, Alabama** is saving approximately 20,000 gallons of treated water during each backwash cycle as a result of using ETSW procedures, and the Governmental Utility Services Corporation (City of Bessemer) Water Treatment Plant is saving between 50,000 and 100,000 gallons per backwash.
- **The Cherokee Water Treatment Plant, North Carolina** has operators working directly with Region 4 staff to achieve a savings of more than 13,000 gallons of backwash water in a single filter backwash cycle using ETSW techniques.
- **The City of Statesville, North Carolina** has calculated that as a result of ETSW, the volume of water it is able to distribute to its customers instead of using it for ripening filters after backwash is saving the utility $66,000 per year.

These examples were provided by Dale Froneberger, Water Protection Division, Region 4, USEPA.

Georgia – Drinking Water State Revolving Find

In 2012, the Georgia Environmental Finance Authority (GEFA) designated $1,000,000 from the small system technical assistance set-aside of the Drinking Water State Revolving Fund to create a Water Loss Audit Technical Assistance Program and a Water Loss Control Grant Program. The first phase of the GEFA Technical Assistance Program was hands-on intensive water audit training workshops for small systems conducted over a 10-month period. The second phase of the GEFA Technical Assistance Program was in the form of grants to assist the small systems with water loss control by conducting finished water meter testing, customer meter testing and pilot leak detection. The successes of the small systems in reducing their water losses was notable as a result of this program.

This information was provided by Dr. Lebone Moeti and Kirk Chase from the State of Georgia.

Mississippi – Capacity Development

Most public water systems in Mississippi rely on ground water, which is generally high-quality and plentiful throughout the state. However, extreme weather events such as yearly tornadoes and hurricanes are common and can cause damage to drinking water infrastructure and facilities.

The Mississippi State Department of Health's (MSDH) Capacity Development program assigns all public water systems a capacity rating between 1 and 5 for three categories (Technical, Managerial and Financial). If a system applies for a loan through the DWSRF program, this information is used to determine eligibility for state funding and prioritize assistance. Emergency preparedness is an important component of the overall capacity rating and includes considerations like whether the system has alternative or backup water supply sources, emergency tie-ins, and/or backup power sources like standby power generators. The Mississippi State Board of Health, the United States Department of Agriculture (USDA) Rural Development and the Mississippi Rural Water Association, Inc. have worked closely with small communities to fund and provide standby power generators in case of extreme weather events. After Hurricane Gustav in September 2008, Mississippi reported that only 28 systems lost pressure due to a lack of generators.

Oklahoma – Statewide Water Supply and Drought Management Plans

The western part of Oklahoma has experienced prolonged drought for several years, which has impacted the quantity and quality of source water for some public water systems in the region. The state believes that enhancing the efficiency of drinking water systems can help stretch out existing supplies, providing critical water services without incurring the larger costs of finding new sources. In FY 2015, the Oklahoma Department of Environmental Quality (DEQ) completed work on a pilot project focused on introducing the concept of water loss auditing to Oklahoma water supplies. 40 public water systems volunteered to participate in the program, in which they received both a water loss audit and training on how to conduct their own future water loss audit according the American Water Works Association M36 method. The pilot project helped participating systems in numerous ways, including how to calculate the volumes and values of both real and apparent losses, and ways to improve the validity of metering and billing data management. Overall, the pilot project indicated that the participating systems were experiencing an average of 26% combined water loss (as a percentage of total water supplied), valued at over $7 Million dollars at retail cost.

Oklahoma DEQ is building on the success of providing improved identification of water loss by continuing to offer water loss auditing services to interested systems (19 additional systems have received a water loss audit and training) and by partnering with the Oklahoma Rural Water Association (ORWA) to provide training and assistance with leak detection and meter analysis at the audited systems.

This information was provided by Brandon Bowman, Capacity Development Coordinator, Water Quality Division, Oklahoma Department of Environmental Quality.

Pennsylvania – Capacity Development

Pennsylvania's Department of Environmental Protection's Bureau of Safe Drinking Water prioritizes water efficiency of public water systems through the DWSRF and Capability Enhancement (i.e., Capacity Development) programs. Pennsylvania's DWSRF program requires applicants to complete a Capability Assessment. Priority systems are followed up with an onsite technical, managerial, and financial capability assessment and completion of a capability checklist that requires a measurement for percent unaccounted-for water. If water losses have been acute (i.e., lead to water outages), then it is counted as a significant deficiency that will need to be addressed as part of the DWSRF-funded project.

Water systems report unaccounted-for water annually through Pennsylvania's online Water Use Data System (WUDS), which gathers data on source water withdrawals/purchases and then how/where the systems use the water. In 2014, the DEP's Operator Outreach program piloted a 1-day water loss course targeted for small water systems with high levels of unaccounted-for water. DEP used the Capacity Development set-aside funds to hire professionals to develop and conduct the training.

This information was provided by Kevin Anderson, at the Pennsylvania Department of Environmental Protection, Bureau of Safe Drinking Water.

South Carolina – Sanitary Survey

South Carolina has experienced severe droughts over the last decade, which have stressed water supplies and presented significant challenges for water systems. The state decided that including water audits in their sanitary surveys would be a proactive approach to help systems withstand and plan for water availability challenges. South Carolina's Department of Health and Environmental Control surveys community water systems annually, and non-community water systems every three or five years. Each system is rated on whether they are performing annual water audits and whether they are using the audit to make improvements. The new program began in fall 2012. Now that most community water systems have gone through the new sanitary survey process at least once, state drinking water staff will focus on helping systems take steps to reduce non-revenue water, including installing meters or making improvements to the distribution systems.

This information was provided by Richard Welch, P.E., at the South Carolina Department of Health and Environmental Control.

Virginia – DWSRF

The Virginia Department of Health's Office of Drinking Water incorporates water efficiency concerns through the use of the DWSRF Capacity Development Set-Aside. Some of these funds are disbursed to the Virginia Rural Water Association for the purchase of leak detection equipment that is used during site visits to water systems in the state. VRWA and state circuit riders provide on-site assistance to locate leaks in the distribution systems. Many systems have reported significant improvements in water loss reduction:

- **City of Norton –** In three days of leak detection assistance, five leaks were located, and two leaks were repaired. As a result, the utility is saving 150,000 gallons of water each day.

- **Alleghany County Public Works –** In three days of assistance, four major leaks were located in three separate areas of the water distribution system. Repairs resulted in a savings of more than 10 percent water loss in each of the three areas.
- **City of Buena Vista –** In two days of leak detection assistance, five leaks were located and repaired. The water treatment plant is presently pumping 250,000 gallons less per day after the repairs.
- **Town of Gate City –** In three days of leak detection assistance, one major leak and several small leaks were located. The major leak was repaired and resulted in the water treatment plant running 4 to 5 hours less per day and pumping 200,000+ gallons less per day.

This information was provided by Barry Matthews, Virginia Department of Health Office of Drinking Water.